Private Sector participation in building resilient Agro-Food System:
Stories of Converging ICT & Agriculture in rural Korea

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Ja Heung Koo
Director, Global Business Group
Why Smart Farm?

Smart Farm industry in Korea

KT Smart Farm

Exploring & Experimenting
Why Smart Farm?

• Where are we?
• Finding New Opportunities
• The Situation
• Farm Demographics in Korea
• Smart Farm Definition
• KT in the Value Chain
Telecommunication Business.

3 SERVICES
- Mobile (4G, 3G)
- Fixed Broadband (FTTH, xDSL, LAN, Sat)
- Fixed Phone (PSTN, VoIP)
- Pay TV (IPTV, Sat TV)
- Others

2 PLATFORM
- IDC
- Cloud
- Big Data
- IoT Platform
- Security

1 INFRASTRUCTURE
- Air
- Space
- Undersea
- Underground
- Others

- 3G, 4G, 5G, WiMAX
- Satellite, land earth station
- Submarine Cable, landing station
- Fiber Optic cable, Copper cable
- LTE drone, LTE backpack
Where are we?
KT until 2012

**Underground**: Fiber Optic cable, copper cable

**Space**: via Satellite

**Air**: 3G, 4G, 5G, WiMAX, Microwave

**Undersea**: Submarine Cable

Why Smart Farm?
Where are we?
KT until 2012

Saturating Market
: Not much room left to grow in the traditional telecom market

Source: KISDI, MSIP (2017)
Finding New Opportunities
Increasing non-telecom sector

Moving into Convergence Business
: Convergence: Merging of distinct technologies, industries into a unified whole)

ICT + Health
ICT + Energy
ICT + Transport
ICT + Agriculture
...

[KT Revenue proportion of Telecom vs. Non-Telecom]

<table>
<thead>
<tr>
<th>Year</th>
<th>Telecom Revenue</th>
<th>Non-Telecom Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>96.5%</td>
<td>3.5%</td>
</tr>
<tr>
<td>2011</td>
<td>88.6%</td>
<td>11.4%</td>
</tr>
<tr>
<td>2012</td>
<td>74.1%</td>
<td>25.9%</td>
</tr>
<tr>
<td>2013</td>
<td>71.4%</td>
<td>28.6%</td>
</tr>
<tr>
<td>2014</td>
<td>71.9%</td>
<td>28.1%</td>
</tr>
<tr>
<td>2015</td>
<td>73.7%</td>
<td>26.3%</td>
</tr>
<tr>
<td>2016</td>
<td>72.0%</td>
<td>28.0%</td>
</tr>
</tbody>
</table>

Source: KT Investor Relations (2017)
Finding New Opportunities
Adding Convergence layer

### 1. INFRASTRUCTURE

- **Air**: 3G, 4G, 5G, WiMAX
- **Space**: Satellite, land earth station
- **Undersea**: Submarine Cable, landing station
- **Underground**: Fiber Optic cable, Copper cable
- **Others**: LTE drone, LTE backpack

### 2. PLATFORM

- **IDC**: Cloud
- **Big Data**: IoT Platform
- **Security**: Others

### 3. SERVICES

- **Mobile**: (4G, 3G)
- **Fixed Broadband**: (FTTH, xDSL, LAN, Sat)
- **Fixed Phone**: (PSTN, VoIP)
- **Pay TV**: (IPTV, Sat TV)

### 4. CONVERGENCE

- **Smart Farm**
- **Smart Energy**
- **Integrated Safety**
- **Networked Transportation**
- **Next Gen. Media**
- **E-Healthcare**
- **Fin Tech**

**Why Smart Farm?**

- Finding New Opportunities
- Adding Convergence layer
The Situation
Looking into Smart Farm Industry

Why Smart Farm?

Government

- Eager to promote Smart Farm industry
- Increase farms using Smart farms / Subsidy, financial instruments and support to farmers in adopting Smart farm / Plans to export Smart Farm overseas in the long term

Demographics

- Farm population average age continues to increase / Farm population continues to decline
- But, Urban to Rural migration is steadily increasing (High competition in Urban areas, Retirement of baby boomer generation) / High ICT Development Index (ITU)

Market

- Market in infancy and expected to grow / Low competition (mostly SMEs in Market)
- Need for Economy of Scale (Smart farm facilities and equipment too costly)
- More competitive food supply from other countries due to FTA
- Need to overcome Lack of Farming manpower through ICT
- Resistance towards large firms entering Agriculture sector from farmers

Technology

- Rapid advancement of ICT that can be used in Agriculture Sector (Sensor, IoT, Big Data, Drone, etc.)

Environment

- Climate Change, difficult to forecast weather

KT

- Need for new market /Use KT’s core strength in telecom/ICT
- Possible to provide Smart farm services even in rural and remote areas (Broadband coverage in Korea: 99.7%, 4G LTE coverage in Korea: 99.9%)
- Well known company and brand especially in rural areas
- 257 regional offices 23, 600 staffs covering all of Korea (operation and Maintenance)
Farm Demographics in Korea
Rural Population is already very small

High % of the population in Korea live in Urban areas.
: Rural population is now 17.5% of the total population

Farm Demographics in Korea

Farm Population continues to decrease.
60+ age group takes up 53.1% of Farm population.

[Source: Kostat, MAF (2016)]

[Source: Kostat, MAF (2017)]
Population returning from Urban to Rural area is steadily growing:
- High competition in urban areas
- Baby boomer generation starts to retire

[Rep. Korea: Population returning to Rural areas for Farming]

Source: Kostat, MAFRA (2017)
**Smart Farm definition**

By International Telecommunications Union (ITU)

**Definition**

**Smart Farming:** Service using networks to actualize a convergence service in the agricultural field to cope with various problems, e.g., time-varying weather changes, growth condition of farm products, and continual diseases or technical problems, such as battery life, sensor malfunctions due to severe conditions, with the aid of information processing and autonomous control technologies of the information technology (IT) area.

Internet of Things (IoT), GPS, Sensors, Big Data, FTTH, LTE, etc.

**Technology**

Agricultural producers, service providers, logistics agents, market distributors, customers and the telecommunications network that interconnects.

To optimize the yield per unit of farming land by using the most modern means in a continuously sustainable way, to achieve best in terms of quality, quantity and financial return.
Smart Farm industry in Korea

- A growing Industry
- Government Support
Korea’s Smart Farm industry is still in its infancy. But it also means there is room to grow.
Policy to widespread use of ICT Convergence

2010:
- Create ICT + Agriculture model to apply to controlled horticulture, livestock, distribution sectors of Agriculture industry.

2013:
- Analyze current Agriculture industry (production, distribution, consumption) to find where to use ICT
- Expand ICT + Agriculture convergence model
- Promote Smart Farm model / Build policies for Smart farm / Foster related R&D

2014:
- Smart Farm adoption to focus on “controlled horticulture” and “Livestock” industry

2015:
- Smart Farm expansion directives
  1. Promote smart farm
  2. Increase productivity rate of smart farm
  3. Create a sustainable eco-system for Smart Farms

2017:
- Provide Smart farms to Controlled Horticulture (4,000 ha), Livestock (700 Farms), Fruit farms (600 farms).

Source: MAFRA, KPMG (2016)
**Government support**

**Farmer’s Expectations and Concerns**

<table>
<thead>
<tr>
<th><strong>Expected Benefits</strong></th>
<th><strong>Concerns</strong></th>
<th><strong>Government Support</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity increase</td>
<td>Need for Financial Support (Initial Smart Farm cost is too high)</td>
<td>Fund for Smart Farms</td>
</tr>
<tr>
<td>Income increase</td>
<td>Reliability issue Will Smart Farm or technology really help?</td>
<td>Use of crowd Funding</td>
</tr>
<tr>
<td>Quality enhancement</td>
<td>Technical limitations Difficult to use ICT</td>
<td>Leasing farm facilities</td>
</tr>
<tr>
<td>Reduced labor</td>
<td>Need for continuous training</td>
<td>Advertise best practice through media, forums, exhibitions, etc.</td>
</tr>
<tr>
<td>Extra income</td>
<td>Lack of standardization of core technology and parts.</td>
<td></td>
</tr>
<tr>
<td>More personal time</td>
<td></td>
<td>Provide training and education. Assist in technology development (R&amp;D)</td>
</tr>
</tbody>
</table>

**Survey**

By MAFRA (2016)

- 107 Smart Farms
- 200 Farms
- 42 Smart Farm Experts

*MAFRA: Ministry of Agriculture, Food and Rural Affairs*
## Smart Farm Industry in Korea

### Government Support

**What Government provides**

<table>
<thead>
<tr>
<th>Eligible sector</th>
<th>Specific items</th>
<th>Subsidy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Horticulture Smart farm</strong></td>
<td>Smart farm (sensors, control panel, etc.) &amp; related equipment (nutrient, sunblock, Co2 etc.)</td>
<td>Government subsidy 20%, Government loan 30%, Rural government subsidy 30%, Farmer 20%</td>
</tr>
<tr>
<td><strong>Fruit Smart farm</strong></td>
<td>Equipment to prevent environment hazards, disease, pests, control equipment to spray water, nutrient, pesticides, information system, etc.</td>
<td>Loan condition: interest rate per annum 2% (3 year grace period, 7 year payback)</td>
</tr>
<tr>
<td><strong>Livestock Smart farm</strong></td>
<td>Feeding and management Software, stable management system and automatic feeder, instrument grader, etc.</td>
<td>Government subsidy 30%, Government loan 50%, Farmer 20%</td>
</tr>
</tbody>
</table>

*Source: MAFRA (2016)*
KT Smart Farm

- Concept & Service Overview
- Smart Farm related Organization
- Support to Smart Farmers
- Smart Farm Benefits
- Journey so far (Reference)
**Concept**

**KT Smart Farm**

1. **Sensing Automation**
   - Maintain Optimal Environment
   - Sensing: Sensor → Collect/Send Environmental Data
   - Automation: Automatic Control of Facility Equipment

2. **Smart Farm Platform**
   - Cloud/Big Data based Control
   - Control Center: Sensor/Environment info Monitoring
   - Smart Farm Platform: Green House Oper. / Manag. System, Crop Cultivation support System
   - Cloud Based IoT Platform

3. **Smart Device**
   - Remote Monitoring/Control
   - Various Devices: Remote monitoring/control via PC, Smart mobile devices.
   - Convenience: Farming Journal
   - Optimal Crop Cultivation Environment
Overview of Services

Smart Farm consists of an operating system that can monitor and analyze crops using Network and control panels.
Overview of Services

Major Components

- **External weather service**
  - temperature sensor, humidity sensor, etc.

- **Controller**
  - wire/wireless combined

- **Power panel**
  - magnetic switch, manual control

- **CCTV**
  - motion detection/moisture-proof

- **Internal sensor**
  - temperature sensor, humidity sensor
Nutrient(watering) control system: automatically provides nutrient(watering) to plant via our control system.

- Automated control and detection of abnormal status
- Premier type can cultivate 2 kinds of plants with 5 kinds of nutrient line

- Prevent sunscald and leaf burn through automatic watering with temperature presets
- Our system can promote the growth of fruit by adding liquid fertilizer supplying line
Overview of Services
Major Components

Internally developed system by KT that increases agricultural production and cultivation efficiency.

Operation Management
- Adjusting cultivation environment for each crop

Integrated Control
- Monitoring the environment of green house

Cultivation Support System
- Providing information and knowledge for cultivating crops

Using Mobile Application
- Integrating the control system via smartphone and tablet application
Overview of Services
Type of Smart Farm

4 types of Smart Farm subject to ecology and scale of crop.

1. **Single-span**
   - Individual greenhouse
   - Small sized greenhouse (0.08hectare)
   - Simple environmental control: single environmental element control (fewer sensors, motors)
   - Representative crop: strawberry, melon

2. **Multiple**
   - Interlinked multi-greenhouse
   - Large scale greenhouse (> 0.33hectare)
   - Complex environmental control: over two environmental element control (insolation, CO2, humidity, etc)
   - Representative crop: tomato

3. **Dome house**
   - Non-photosynthetic plant
   - Simple environmental control: fewer sensors – no need to control light
   - Representative crop: mushroom

4. **Plant factory**
   - Advanced farming under automatically controlled facility (insolation, temperature, humidity, nutrients, etc)
   - Representative crop: lettuce, ginseng
Overview of Services
Implementation process

Foundations
- Consider Soil, bearing power
- Grounding and leveling work
- Drainage work

Steel-frame work
- Width/height: 8m/5.5m
- Column space/beam: 4m/8m
- Steel frame fabrication

Sheathing work
- Material: PO film (polyolefin)
- Thickness: 0.15mm

Nutrient solution irrigation
- Horizontal full-wire system
- Heat reserving/light shading → dual screen

Heating work
- Rail heating considering uniform heat generation (6 lines/bay)
- Select boiler capacity/thermal storage tank

Bed
- Slab: 6 lines/bay
- Consider Plumbing space/hot water/nutrient/acid tank

Smart farm solution
- 6 lines per greenhouse
- Able to adjust the height
- Elevated bed for easy farming

Support PC, mobile access
- Remote integrated control
- Provide correlation between growing environment and crop (in near future)
Using the industrial drone in agriculture to support labor force, to increase productivity of crops and to support controlling Smart Farm’s facilities.

**Effects: Reducing resources and increasing Productivity**

1. Support labor force in rural area
2. Rapid decision using detailed monitoring and analyzing
3. Possible to control larger area
4. Effective distribution of fertilizer and pesticide

**Coverage**

1. Monitoring the farm
2. Distribution of fertilizer and pesticide
3. Monitoring insects and crops
4. Predict crop production
Smart Farm related organizations in KT
From Research Centre to SMEs

- Future Convergence Group
  Domestic Business

- Global Business Group
  Expanding Overseas

- Global Startup Accelerator:
  Working with SMEs

- Smart Farm Research Center
  R&D

- Public Affairs Group
  CSR Program

KT Smart Farm
Help and support available in order to solve difficulties in ICT Technology use in collaboration with RDA (Rural Development Administration).

- Experience & Learn about Smart Farm & Available Hands on Training
- Hands on Education & Training
- Experience convenience & efficiency of Smart Farming

5 Smart Farm Hands-on Training Centre.

- A/S support near main production site
- Dedicated Smart Farm Call Center (1522-0421)

5 Site support Centre
Support to Farmers
Nationwide support and Training Center

[KT Smart Farm training centre in Yong-in city Agricultural Technology Centre]
Smart Farm Benefits
Still a long way to go

Strengthening agricultural Competitiveness and increasing profit.

Gaining competitive edge through Smart Farm

- **Extension of income base**
  - Controlling harvesting environment based on use of big data
  - Easy implementation using both S/W and H/W module

- **Stable profit growth all year round**
  - Harvest crops all year round

- **Helping new farmers to settle in**

- **Sharing new farming technologies, knowledge (best practice)**

- **Assist in marketing and promotion**

Smart Farm productivity breakdown*
(Scale: %)

<table>
<thead>
<tr>
<th></th>
<th>Production amount</th>
<th>Production amount/person</th>
<th>Labor cost</th>
<th>Disease/insects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in production amount</td>
<td>27.9</td>
<td>40.4</td>
<td>-15.9</td>
<td>-53.7</td>
</tr>
</tbody>
</table>

- ✔ Implementation of Smart Farm results in increasing production amount, but decrease in labor cost, disease and insects.

Source: MAFRA, SNU (2016)
KT has various ICT convergence references in agriculture field.

<table>
<thead>
<tr>
<th>Date</th>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>• Mushroom Smart Farm construction (Yeosu region)</td>
</tr>
<tr>
<td></td>
<td>• Mushroom Smart Farm construction (Jeju Island region)</td>
</tr>
<tr>
<td></td>
<td>• Single/Multiple unit Smart Farms construction: 100 farms</td>
</tr>
<tr>
<td>2016</td>
<td>• Mushroom Smart Dome House (Jinju region)</td>
</tr>
<tr>
<td></td>
<td>• Smart Farm for the Disabled (Namyangju region)</td>
</tr>
<tr>
<td></td>
<td>• Single/Multiple unit Smart Farms construction: 200 farms</td>
</tr>
<tr>
<td>2015</td>
<td>• Mushroom Smart Farm construction (Masan region)</td>
</tr>
<tr>
<td></td>
<td>• Controlled environment system construction for Tomato Smart Farm</td>
</tr>
<tr>
<td></td>
<td>• Smart farm village environment control system construction: Ministry of Agriculture and Forestry</td>
</tr>
<tr>
<td></td>
<td>• Strawberry Smart Farm construction</td>
</tr>
<tr>
<td>2014</td>
<td>• Smart Farm construction (Shiitake- Kaneong Satdol village)</td>
</tr>
<tr>
<td></td>
<td>• Controlled environment system construction for Smart Farm</td>
</tr>
<tr>
<td>2013</td>
<td>• Nutrient system construction</td>
</tr>
<tr>
<td></td>
<td>• Nutrient system construction (Japan)</td>
</tr>
<tr>
<td></td>
<td>• Fruit tree Nutrient system construction</td>
</tr>
<tr>
<td>2012</td>
<td>• Operation system construction (Kyunggi province Eco-Distribution Center)</td>
</tr>
</tbody>
</table>
Exploring & Experimenting

- Smart Farms to Bridge gaps (LED & Heating, for Schools, for the Disabled, simple sensors).
- Others (GS1 Agri-food information, e-commerce platform)
GiGA Island projects (2014 - )
: Connecting 6 remote and isolated areas
<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Imja Island</td>
<td>a. Standard Smart Farm</td>
<td>b. Smart Farm for School</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Baengyeong Is.</td>
<td>a. Standard S. Farm +</td>
<td>b. LED lighting</td>
<td>c. Hotwire Heating</td>
</tr>
<tr>
<td>3</td>
<td>Gyodong Is.</td>
<td>a. Standard S. Farm +</td>
<td>b. Water level sensors</td>
<td></td>
</tr>
</tbody>
</table>
### Smart Farm for the Disabled

| ① | Easy Access to the disabled people |
| ② | Height adjustment & Space utilization |
| ③ | Floors with wheelchair access |

- **1** Automatic door
- **2** Hanging bed
- **3** Rubber floor

**Smart Farm to Bridge Gap**
Smart Farm for the Disabled
Working together to create an e-platform for local agriculture in Moheshkhali island (Bangladesh).

: Telecom infrastructure already built by KT

[Overview of e-platform]

Dhaka

Customer

Warehouse

① Online order (Price is set by farmers)

② Receive order

③ Check inventory

Moheshkhali Island

Farms

④ Collect via Rickshaw

e-Business Centre

⑤ Storage (Quality control)

⑥ Delivery within 24 hours

⑦ Arrive in 1 of 3 Dhaka warehouse (Quality control)

⑧ Delivery to customer
Exploring & Experimenting

Others

e-Platform for Agriculture (Bangladesh)

5  e-Platform for Agriculture

An on-going project in Moheshkhali Island (Bangladesh)

[e-Business Centre in Moheshkhali Island]

[e-commerce website]
Exploring & Experimenting

Others
GS1 Agri-food information (GSMA)

6 GS1 for Food Safety
Exploring & Experimenting

Convergence R&D Centre:
- Experimenting with Household Smart Farm, Container Smart Farm, Vertical Smart Farm.
- Experimenting with new agriculture products

What’s Next
Smart Farm Test Bed
What’s Next?
Working with Agriculture sector

A lesson for ICT companies entering the Agriculture Sector:
LG CNS plans to build 76 ha Smart Biopark in Korea (2016) cancelled.

“Smart Farm experts know about Technology and ICT
But there are only a very few who really know about the agriculture industry. “
- Interview from a farmer

Source: Local newspaper article (2016)
What’s Next?
Working with Stakeholders
Thank you
Korea Telecom

- Established: December 10, 1981
- Revenue: USD 20.7B (2016)
- No. of Employees: 23,600 (As of Sep 2016, kt only)
- Stock Exchange Listings: Korea, New York
- Credit Rating: A3 (Moody’s) / A– (S&P, Fitch)

Number of Subscribers (As of Dec 2016)

<table>
<thead>
<tr>
<th>Mobile</th>
<th>Fixed Broadband</th>
<th>Fixed phone</th>
<th>Pay TV</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.6%</td>
<td>41.4%</td>
<td>80.6%</td>
<td>51.9%</td>
</tr>
<tr>
<td>(18.9M)</td>
<td>(8.5M)</td>
<td>(12.7M)</td>
<td>(9.3M)</td>
</tr>
<tr>
<td>LTE: 14.3M</td>
<td>3G: 4.6M</td>
<td></td>
<td>IPTV: 5.0M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IPTV+SatTV: 2.0M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Satellite TV: 2.3M</td>
</tr>
</tbody>
</table>

Source: kt, Ministry of Science ICT Future Planning, Korea Communications Commission